Jacobi

CONTRIBUTIONS

TO THE

ANATOMY AND PATHOLOGY

OF THE

THYMUS GLAND.

BY

A. JACOBI, M.D.,

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The pathology of the thymus gland and its literature have been extensively discussed of late by Giuseppe Somma ("Sulla tracheostenosi per ipertrofia congenita del timo," in *Arch. di patol. inf.*, 1884, fasc. 4), and A. Sanné (Art. "Thymus," in *Dict. Encyclop. des sciences méd.*, 1887). Otherwise the literature of the thymus, for the last thirty years, since Alexander Friedleben published his exhaustive and brilliant monograph on "Die Physiologie der Thymusdrüse in Gesundheit und Krankheit vom Standpunkte experimenteller Forschung und Klinischer Erfahrung" (Frankfurt A. M., 1858), has been mostly confined to embryology and histology.

In the following pages, therefore, I venture to offer, with a few remarks and cases, the results of some researches into the anatomical relations, and some pathological conditions of the thymus. The specimens have been prepared and the microscopical examinations made by my young friend, Dr. Henry Koplik, mostly in the laboratory of the College of Physicians and Surgeons of New York. The anatomical material required came from several institutions of the city. It is mainly to the kindness of Dr. W. P. Northrup, of the Foundling Asylum, that I am indebted for most of the available cases, with the reports of both their autopsies and histories.

Of the whole number of cases, thirty-two were carefully examined. Amongst them there were four of tuberculosis, one of which was excluded because both the history of the case and the necropsy were incomplete. There were five cases of syphilis, one of which was thrown out because its history was defective. Three were fully examined. Of diphtheria there were many specimens; nine of them

were also investigated with great care. Besides, there was a specimen of persistent thymus taken from an adult.

Plates I.–VII. were taken from the frozen sections of a newly born normal baby. They were made for the purpose of establishing the exact location of the thymus gland. All the sections were made one centimetre apart, with the exception of Plate II., which is but half a centimetre in thickness. The first and sixth sections exhibit the upper aspect. We look down upon it. In Plates II., III., IV., and V. we look up toward them. The plates are taken from the full sizes, the specimens having shrunken since, say, to five-sixths or seven-eighths of the original size.

Diseases of the Thymus.

Friedleben's conclusions derived from the closest possible study of the whole literature, and many researches of his own, lead to the results that the diseases of the thymus are quite rare, and that the conditions of hyperæmia and apoplexy, besides those depending on violence experienced during parturition, and tuberculous degenerations, have indeed been met with, but very much more rarely than some authors had supposed them to occur. The large majority of observations alleged to be those of diseases of the thymus, were, according to him, no diseases of that or any other organ. He could not ascertain any positive symptoms during life belonging exclusively to such presumed diseases. There was but a single *abscess* of the thymus at this time, and that also exhibited no recognizable symptoms.

Hypertrophy.

The existence of a hypertrophy of the thymus gland has often been both asserted and denied. It is a fact that its weight may vary between a few and nearly five hundred grains, without giving rise to any symptoms whatsoever. According to Friedleben, the thymus, both normal and abnormally large, cannot impede respiration or circulation, or irritate the respiratory nerves, or disturb the cerebral circulation or the innervation of the muscles controlling the glottis, or be subject to a periodic turgescence by impeded circulation. Before him, as early as 1847, Herard reported, in his inaugural thesis, "Du spasme de la glotte," his examinations of the thymus of sixty infants,

particularly with regard to its weight. He found the weight very variable, and that it depended on the constitution of the infant, and the degree of its emaciation, but also came to the conclusion that the bulk would vary considerably both in a healthy condition and in what was called thymic asthma.

West admits the existence of thymic asthma, and reports a single case without attributing to it the same symptoms found in the common forms of spasm of the glottis.

Rilliet and Barthez look upon spasm of the glottis as a convulsive, not a compressive affection. Sanné also makes a difference between the convulsive and the compressive form, and expresses the opinion that when the degenerated thymus or lymphatic glands are sufficiently large to compress the trachea and the adjoining nerves, particularly the inferior laryngeal, the consequences differ from the symptoms of glottic spasm.

Now, the distance, in the skeleton of an infant of eight months, between the manubrium sterni and the vertebral column amounts to two centimetres. Thus it is clear that a thymus gland of the size reported above, particularly in cases of temporary congestion and swelling, is sufficient to fill the whole space, compress the neighboring organs, and result in death. Thus it is quite possible to explain an occasional case of sudden death, and the so-called thymic asthma by an hypertrophy of the thymus gland, though the large majority cannot be referred to such a cause. It is well known that the large majority of cases of laryngismus stridulus or spasm of the glottis have to be explained by changes in the nerve centre. It ought to be taken as an established fact, that most cases are due to meningeal and encephalic hyperæmia and effusion resulting from the changes produced by general rhachitis.

Until about twenty years ago, the several forms of rhachitis were not frequent amongst us. Particularly rhachitical softening of the cranial bones ("craniotabes"), and its cerebral results, were quite rare. Laryngismus stridulus was quite uncommon. It is not difficult to find the reasons for this peculiar fact. At that time the number of very poor people, with all the diseases of abject poverty, was quite small amongst us. Since that time the indiscriminate immigration of hundreds of thousands every year, of the lowest classes of all the nations of Europe, has greatly changed the average social and hygienic

condition, and rhachitis has become quite frequent, with all its consequences. Thus it is that thymic asthma, or laryngismus, has become quite frequent amongst us, though certainly the sizes of the thymus glands have not increased.

Still, sudden deaths, resembling those published by Grawitz, have been observed in a very few instances. One of his cases was that of a child of eight months, who was found dead in bed, after having been in perfect health. At the post-mortem examination absolutely nothing was found to explain death, except a thymus of unusual size, which was flattened, and covered the larger part of the pericardium, and extended upward to an unusual degree in the direction of the thyroid gland.

The second was a babe of six months, in perfect health, which, while being carried on the arm of the father, was taken with an attack of dyspnœa, became cyanotic, and died in a few minutes. At the post-mortem it was found that there was a large amount of subcutaneous fatty tissue, and symptoms of rhachitis about the chest. The thorax was broad, and the abdomen somewhat inflated. The diaphragm reached upward to the fourth rib on both sides. The thymus was very large, its two lobes covering the larger part of the pericardium, and two processes reached upward to the thyroid gland. Longitudinally it measured seven and a half centimetres; over the pericardium it was more than six centimetres wide; its thickness was one and a half centimetres, with the exception of the region of the manubrium sterni, where the dorso-ventral diameter amounted to one and four-fifths centimetres. The tissue of the thymus was of a grayish-pink color, quite firm, and contained a great many punctated hemorrhages. There was a large amount of blood in the heart and the two venæ cavæ. The epiglottis was compressed from the two sides. The spleen was large, and the mesenteric glands were larger than normal.

Goodhart (*Brit. Med. Journ.*, 1879) reports a case of enlargement of the thymus in an infant of eight months, in which suffocatory and epileptiform attacks proved fatal.

Clar (*Jahrb. f. Kinderh.*, 1858) relates eight observations of asthmatic attacks in children, explained by hypertrophied thymus glands. Two were girls of sixteen days and two months in whom death resulted from a sudden swelling of the organ. Two died of pulmonary catarrh which was increased by the hypertrophied gland. In a boy of one

year and nine months, who suffered from croup, the introduction of the tracheotomy tube proved impossible from the same cause.

Amongst a great many cases of laryngismus stridulus, I have met with but a dozen sudden deaths. In but one of those which I could examine after death, I found the cerebral and meningeal changes of rhachitis insufficient to explain the fatal termination. In that one case the thymus of the baby (boy of six months) had a weight of four hundred and ten grains, and I felt justified in attributing the sudden death of the patient to the size of the thymus gland.

Hemorrhages.

Hemorrhages into the tissue of the thymus, and into its capsule, mostly at its inner surface, are by no means rare. Scores of them, of the size of a pin's head and less, may be found in babies dying a few days after birth from, or with, disorders of the scarcely established circulation. Atelectasis, pneumonia, congenital heart diseases, will result in so much venous congestion as to burst numerous small bloodvessels in many organs, principally, but not essentially, of the thoracic cavity.

Péan (*Bull. Soc. Anat.*, 1857, vol. 32, p. 375) describes the case of a thymus very much enlarged, which had the appearance of spleen tissue and presented a number of hemorrhages, varying in size from that of a pin's head to that of a grain of oats. The specimen was taken from an infant who died with hemorrhagic purpura at the age of eleven months.

Cysts.

Bednar met with cysts containing a clear yellowish serum. Some had the size of beans, some were quite large and replaced the lobes of the organ. Were they the results of softened gummata? or not, rather, the results of hæmatomata changed in the manner in which they will be transformed, in the cranial cavity, into pachymeningeal cysts?

Inflammation.

Inflammations of the thymus have been described, but it has been found impossible to distinguish them from their complications. Thus

E. Lancereaux (*Traité d'Anatomie Pathol.*, ii. p. 628) speaks of exudative, suppurative, hypertrophic, tuberculous, and syphilitic inflammations. Two cases of inflammation of the capsules of the thymus have come under my observation, but neither of them was primary. One of them appeared to be secondary to a general medi astinitis and pericarditis. The capsule was very hyperæmic, thickened, and fibrinous deposits were found on it.

The second case was one in which there was a considerable amount of fibrinous pleuritis on both sides. The capsule of the thymus was thickened, covered with thick layers of fibrin, was easily peeled off the organ; the latter was hyperæmic, and contained a few punctated hemorrhages. In this case there were in the neighborhood a considerable number of enlarged mediastinal glands.

It is the opinion also of Sanné, that inflammations of the organ and its capsule are mostly not of a primary character, but the results of difficulties experienced during parturition, and generally attended with hyperæmia, œdema, and hemorrhages in other places. Similar cases have been mentioned by Veron, Billard, and Weber.

Wittich (*Virchow's Arch.*, viii. p. 477, 1855) reports the case of a young man of eighteen, who complained a long time of a retro-sternal pain and intense dyspnœa, particularly when in the recumbent position. After having suffered several months, he was admitted to the hospital, where he died, in an attack of suffocation, with hydrothorax and ascites. There was found at the autopsy bilateral pleurisy with bloody and serous effusion; no tuberculosis; plenty of adhesions; in the left upper lobe, emphysema, in the left lower lobes, atelectasis; the external layer of the pericardium considerably thickened and discolored by pigment. The pericardium at its base was seven inches wide, its height from four to five inches. There was a large tumor which contained some normal tissue of the thymus gland, some cavities filled with pus and surrounded by a hyperæmic zone, other cavities filled with serum, pigmented granulations, and some fat. It could not be separated from the pericardium, the large bloodvessels, and the trachea. Even in this case it is very difficult to say whether the tumor was primary or not, for it is possible that it originated in the pericardium, the external layer of which was affected, or that it was the result of progressive mediastinitis.

Malignant Tumors.

The case of primary *medullary sarcoma* reported by Astley Cooper in a girl of nineteen years is considered as extremely doubtful by Friedleben. Birch-Hirschfeld, however, expresses the opinion that many of the tumors of the anterior mediastinum originate in the thymus.

Steudener (*Virch. Arch.*, vol. 59, p. 463, 1874) reports the case of a child of one year, who died of pneumonia of the right lung. There had been no symptoms previously, but there was found a *hemorrhagic sarcoma* consisting of round cells which originated in the thymus, perforated its capsule in different places, and adhered to the large bloodvessels.

Soderbaum and Hedenius published, in 1878, the case of a man of twenty-two who had been suffering for some time, without a diagnosis of his condition having been made. He had a mild attack of pleurisy and cough, both of which disappeared, but a certain degree of dyspnœa remained, increased gradually, particularly in certain positions. After a while there was œdema of the upper part of the body. There were no attacks of suffocation, but dyspnœa increased, and he died nineteen months after admission. There was a tumor of the thymus quite circumscribed, surrounded by signs of mild vascular irritation, compressing to a certain extent the neighboring bloodvessels and bronchi. It consisted of two parts, the anterior portion containing a large amount of fat and lymph elements, epithelial cells, and the characteristic concentric bodies of the thymus gland. The posterior part contained connective tissue cells in various degrees of development.

Vogel observed two boys of from five to six years of age with a *carcinoma* which, to judge from the position of the tumors, originated probably in the thymus gland.

T. Grützner published in 1869 (*Berlin Inaug. Diss.*) the case of a boy of eight years, whose family history was good, who died with a large tumor, diagnosticated post-mortem as a lymphosarcoma. Immense masses of cells were accumulated in the reticulated connective tissue. Its origin was assumed to be the thymus gland, for the main bulk was uniform in both its texture and outlines, and did not make

the impression of a conglomerate of enlarged and degenerated lymph bodies.

One of two cases described by Rosenberg (*Inaug. Dissert.*, Gottingen, 1884) was that of a boy of five years, who died with a lymphadenoma filling the whole mediastinum. It was closely adherent to the sternum, extended into the right pleural cavity, and was strongly adherent to the lower anterior part of the right upper lobe. It was assumed to be thymic, because no trace of the thymus could be found. Besides, it was homogeneous in its structure and not nodulated like a conglomerate of lymphomata, and was located in front of the pericardium, behind the sternum.

S. Bollag reports (*Inaug. Diss.*, Brugg, 1887) a lymphosarcoma of the thymus, observed in a boy of fourteen years who died in the University hospital of Zurich in 1883. It was located in the mediastinum, originated in the thymus, and resulted in secondary sarcomatous degeneration of the lymph bodies and the parietal pericardium. Moreover, there were hemorrhagic pericarditis, compression of the trachea and of the vena cava superior. There were, in consequence, extensive œdema, bilateral hydrothorax, compression of the lower parts of the lungs, protrusion of the sternum, and dislocation of the liver.

Jules Simon has collected, in his inaugural thesis, a few cases of enlarged thymus implicating *leucocythæmia*. One such case has been detailed by Augustin Fabre ("Fragments de clinique méd.," Paris, 1881). The leucocythæmia was both splenic and lymphatic. There were pleurisy of the left side, œdema of the left upper extremity, considerable dilatation of the veins of the thoracic wall and of the left shoulder. The only symptom perceptible during life was extensive dulness over the manubrium sterni. The latter was the only symptom distinguishable in the single case of the kind that has been observed by me. A child of two years had dyspnœa, dilated veins, œdema of the face and neck, and a high degree of anæmia. The tumor was taken for a mediastinal growth. The diagnosis of leucocythæmia was made, fortunately, before death, when the spleen was found greatly enlarged. The thymus was changed into a lymphosarcoma, and some of the mediastinal glands were altered in the same manner.

Persistent Thymus.

Persistent thymus has been described occasionally, thus, for instance, by Alexander Bruce ("Specimens of thymus remaining to a later period of life than normal," in *Trans. Pathol. Soc.*, 1867, vol. xviii. p. 263). Before him, Haugsted observed a persistent thymus in a boy and girl of ten years, and a young man of seventeen, and Krause, in two men of twenty-five years, and in a woman of twenty-eight. Though there be a number of other observations of the kind, the examination of a case of persistent thymus which came under our notice will still be found interesting.

Persistent Thymus in the Adult.—The above was removed from the body of a male, aged twenty-six years, the cause of whose death seemed to be unknown. At least, no positive lesion was found post-mortem. Dr. Van Gieson, of the Pathological Laboratory of the College of Physicians and Surgeons, of New York, furnished this specimen and kindly allowed us to make sections and study the same.

When found, it appeared as a small, pinkish tumor in the anterior mediastinum in front of the pericardium. It weighed, when hardened, 11.50 grammes. Macroscopically it appeared, on section, to be composed of yellowish, firm islets of tissue, separated by tissue less firm and more whitish in color.

When double-stained the above firmer areas (lobules) must be recognized as the remains of the thymus parenchyma; they were surrounded by fibrillar connective tissue from which trabeculæ were given off dividing these areas after the manner of acini or follicles. The tissue in these areas was composed of a mass of small and large round cells. In spots there were spindle-shaped cells, the whole having a finely fibrillated basement-substance.

The small round cells were so closely packed as quite to conceal the basement-substance. The whole was much firmer than generally normal to the thymus. In the midst of the acini were met the characteristic concentric bodies found in the normal thymus. Some of these showed calcific changes, others still maintained their characters of a capsule with concentrically arranged layers of epithelioid cells.

The bloodvessels of smaller size in the acini were in places found to have undergone obliterating changes. In some places the coats were

*

infiltrated with round and spindle-shaped cells. The lumen was filled with connective tissue.

The tissue between the above-described areas was in every way identical with adult fat tissue (see Plate VIII.).

Diagnosis: the connective tissue originally separating the acini of the thymus was replaced by fat tissue. The parenchyma could be distinctly seen to have yielded to the invasion of fat tissue. In places only a small area of round cells (appearing as if they infiltrated the fat tissue) was all that remained of the original acinus of the thymus. The characters of the above persistent areas correspond to the picture given in the normal thymus, allowing for physiological changes.

Tuberculosis of the Thymus Gland.

The literature of tuberculosis of the thymus gland is quite scanty. Indeed, there is hardly any. In the *Études expér. et clin. sur la tuberculose*, published under the direction of Prof. Verneuil (1887 and 1888), it is not even mentioned. The second edition of H. Hérard, V. Cornil, and V. Hanot's *La phthisie pulmonaire* (1888) contains a few remarks on tuberculosis of the thyroid body, but no mention is made of that of the thymus. And A. Predöhl's *History of Tuberculosis* (Hamburg and Leipzig, 1888) refers to no instance of tuberculosis of the thymus besides the case reported by Demme, to which I shall allude below.

Sanné quotes Harder, who describes a blackish and indurated thymus in a boy of fifteen years, who died of consumption; and Budaeus, with the report of a man who died at thirty-two years of age, with an enlarged and "scirrhous" thymus. But most of the old observations suffer from insufficient observation and examination.

It appears that mistakes in regard to the diagnosis of tuberculous changes in the thymus gland are quite possible. The neighboring lymph bodies are certainly much more liable to undergo tuberculosis than the thymus. Probably the case of primary invasion claimed by Bednar (*Die Krankh. d. Neugeb. u. Säugl.*, 1857, p. 94) to have taken place in the thymus, means, indeed, a tuberculous swelling of an adjoining gland. I have met with exactly such cases, in which the thymus was reduced to a very small size by being compressed by a large tuberculous tumor in the neighborhood. In such a case the

atrophy can be so considerable that nothing appears to remain but a thick layer of capsular tissue closely adhering to the tumor. Still, Vogel and Bednar report the observation of large "tubercular" tumors without any tumefaction of the neighboring glands.

There is but a single well-authenticated case of isolated primary tuberculosis of the thymus in modern literature. It is that of R. Demme, published in the *Twenty-second Annual Report of the Children's Hospital in Bern*, 1885. The case is that of a newly born male, the child of non-tuberculous parents. He weighed 2780 grammes at birth, and was nursed at the breast of the mother for three weeks; afterward, on cow's milk. From that time on he became emaciated, suffered from diarrhœa, and showed all the symptoms of general debility; there was absolutely no physical symptom except some dulness on percussion over the manubrium sterni, until he died on the forty-second day. The thymus was found to be quite large, and its tissue dense. In it there were three tubercles of the size of a pea each, and one of the size of a hazelnut. In these tumors some tubercle bacilli were found. In no other organ were there any tubercles or cheesy degenerations.

CASE I. *General tuberculosis; meningitis.*—Joseph B., aged seven and a half months.

January 27, 1888. Returned to asylum from his private domicile. Has been restless for three days; obstinate constipation. Temp. 99½°.

28*th*. Temp. 102°; evening 104°. Resp. irregular. Sordes on lips; fontanelle elevated; abdomen retracted; reflexes good. No convulsions; neck not stiff. Pupils not dilated; respond to light. No cough. Inclined to stupor. Quiet at night. Restless last night and this A. M. Is teething.

29*th*. No constipation. Temp. 100°, pulse 130, resp. Cheyne-Stokes. Eyeballs twitching; eyes half closed. Face flushed. Tâche cerebrale absent.

30*th*. Stupid. Dulness at upper part left side. Pupils slightly contracted; conjunctivæ congested. Marked Cheyne-Stokes resp. Temp. 103°, pulse 196. Eruption over abdomen. No convulsions; neck stiff. P. M. temp. 107½°. Died 10 P. M.

Autopsy. 31*st*, 1 P. M.—Body well nourished; fontanelles elevated.

Brain: Ventricles much distended by serous fluid (℥iij). Convolutions flattened. Fine tubercles everywhere along vessels and over base; also choroid plexus; œdema and infiltration of pia mater at base.

Spinal cord: Tubercles on dura.

Lungs: Adhesions at left apex, and beneath is a fluctuating cavity filled with pus and detritus. Scattered miliary tubercles over surface and on left pleura and left diaphragmatic pleura.

Bronchial glands enlarged; tubercular; some cheesy. Liver not large; miliary tubercles discrete. Spleen not large; miliary tubercles discrete Kidneys, miliary tubercles discrete. Mesenteric glands moderately enlarged; miliary tubercles. Heart, normal. Heart, ℥j; liver ℥vijss; spleen, ℥vss.

The portion of the thymus which was hardened in alcohol and was taken from the anterior aspect of the organ, contained an area of grayish-white color more compact than the remainder of the thymus tissue. This area (measuring five mm. by two mm.) occupied that portion of the thymus anteriorly just beneath the capsule, but in the tissue substance proper of the thymus.

Sections stained with hematoxylon and eosin and picro-carmine showed that it was wholly made up of a number of miliary tubercles (a recent eruption) taking up the whole space allotted to an acinus of the thymus. Each tubercle granulum consisted of a giant cell, around which were arranged spheroidal and polygonal cells. There was no area of cheesy degeneration seen. The spaces between these formations were filled with small round cells.

The walls of the smaller and medium-sized arteries, both in the above area and in the neighboring acini of the thymus, were the seat of an endarteritis of a tubercular character.

The adventitia and media were infiltrated with round cells; the lumina of the smaller vessels were obliterated. In some cases the lumen was replaced by a mass of small round cells. The septa of the thymus in different parts of the organ were infiltrated with tubercle tissue, and the vessels of small calibre were also the seat of tubercular changes.

Tubercle bacilli were found in the giant cells of the miliary tubercles, in the centre and periphery of the tubercle granula, in the spaces between the cells of the tubercle. They were present also in the walls of the bloodvessels which were the seat of endarteritis. They were found in the lumina of some of these vessels. They existed in the connective-tissue septa separating the acini of the thymus, which septa may be the seat of an infiltration of tubercle tissue. In this thymus tubercle bacilli were found in those encapsulated nests of epithelioid cells which exist in the thymus and are characteristic of its structure. Here the tubercle bacilli were seen in the connective-tissue capsule and between the cells in the interior of these bodies. This was the case in the acini, the seat of eruption of miliary tubercle, and also in places quite distant from the same. Tubercle bacilli were found between the lymphoid cells (in lymph spaces) of the thymus, quite distant from the miliary tubercle in acini apparently not yet the seat of infiltration with tubercle tissue.

Case II. *General tuberculosis.*—Jennie A., aged eight months and nineteen days. Entered asylum June 10, 1887, three weeks old. Condition poor. Had snuffles. Wet-nursed up to January 24, 1888, when she was returned from boarding; then bottle-fed. Condition: Emaciated; enlarged cervical glands; did not improve. Died February 8, 1888, 10 A.M.

Autopsy. Feb. 8, 2.30 P.M.—Body poorly nourished. Right lung: tubercles; also over right pleura, along posterior margin. Bronchial glands lying against right lung are tuberculous. Left lung and pleura normal. Mesen-

teric glands enlarged; one tuberculous. Agminated glands of intestine enlarged. Liver and spleen tuberculous. Kidneys normal. Body, 8½ pounds; liver, ℥ vij ℥ ivss; spleen, ℥ ivss; heart, ℥ vijss; thymus, ℥j grs. xviij.

The thymus was hardened in Müller's fluid and alcohol. On cutting the thymus two nodules of a cheesy character, on close examination, were found in the lateral portion of the organ and within its structure. One of these nodules was quite large, the size of a bean, the other much smaller. Under the microscope, the above nodules were found to have a large, cheesy centre, and a periphery composed of a number of tubercle granula, which contained giant cells, around which were found spheroidal or polygonal cells, both small and large; between these granula were small and large polygonal cells (tubercle tissue). The nodules were limited to a sort of connective-tissue capsule which belonged doubtless to the limiting connective-tissue septa of the acini of the thymus.

In some of the tubercle granula above mentioned there were cheesy areas (coagulation-necrosis). The septa limiting the acini in various parts of the thymus were infiltrated with tubercle tissue. The bloodvessels of smaller size in these situations were the seat of an endarteritis of a tubercular nature. The adventitia and media of some of the medium-sized vessels were in a state of hyaline change, and infiltrated with small round or spheroidal cells. In some places the smaller arteries were obliterated, the lumen having been replaced by spheroidal or epithelioid cells.

Sections of the thymus were placed in alcohol, and stained by the Koch-Ehrlich method, both double and single stain. Tubercle bacilli appeared in the areas of coagulation-necrosis, in the tubercle granula, both at their centres and peripheries. The walls of the bloodvessels were the seats of tubercular endarteritis. Tubercle bacilli were present in the tubercle tissue infiltrating the septa of the thymus in various parts of its extent. There were tubercle bacilli in places within the acini apparently free from the presence of any distinct tubercle formation. The bacilli were situated in the spaces between the lymphoid cells of the thymus.

Case III. *General tuberculosis; convulsions.*—Marion W., aged four months January 17th, put out to wet-nurse; nurse's health failed; then bottle-fed after the middle of February. April 17th: Slight cough: constipated; head retracted; slight convulsive twitchings. 19th: Quieter; green undigested passages. Returned April 25th in convulsion; collapse followed. Died April 26th, 1 A.M.

Autopsy. 2 P.M.—Body well nourished. Brain normal. Double bronchopneumonia, chiefly on right side; some tubercles; bronchial and tracheal glands enlarged, cheesy. Tubercles in *pleura, liver, and spleen.* Kidneys markings slightly indistinct. Mesenteric glands enlarged. Intestines pale, empty (from oil and injections). Peyer's patches enlarged. Body, 12½ pounds; heart, ℥j ℥vss; liver, ℥viij ℥ij; spleen, ℥iijss; thymus, ℥iij grs. xj.

The thymus was hardened in Müller's fluid, and portions in alcohol. The organ showed on section the presence of a number of small grayish-white bodies occupying the anterior portion of the thymus. The tissue between

these bodies (miliary tubercles) appeared denser and darker in color than normal. On microscopical examination, these bodies were found to be an eruption of miliary tubercles. These were composed entirely of small round or polygonal cells; at the centre of some of these collections or areas there were cheesy changes (coagulation-necrosis). In the periphery of these miliary tubercles the basement-substance showed fully well as a fine reticulated tissue forming spaces in which the round cells were found in other cases empty (per drawing). The tissue between the miliary tubercles was composed of round cells closely packed, in no way differing from the normal lymphoid cells of the thymus. They were more numerous, however. The smaller bloodvessels in but very few instances could be found the seat of endarteritis.

A careful examination found tubercle bacilli (as in drawing) in *moderate* numbers in the cheesy centres, and in the periphery of the miliary tubercles, and also present in the tissue between the miliary tubercles.

Methods of Investigation.—The hardening fluids used were Müller's fluid and alcohol, simple alcohol, corrosive sublimate, chromic acid (one-half per cent.). Those portions of the thymus which were hardened in corrosive sublimate at a temperature of about 48° C. (118° F.) for nearly fifteen minutes and then placed in alcohol, first dilute and then strong, became quite brittle, and though they cut fairly well, they stained very badly with hæmatoxylin and eosin, or picro-carmine. The most satisfactory methods were alcohol or Müller's fluid. Paraffine and celloidin were used as embedding material, the latter in most cases. For tubercle bacilli, the methods recommended by Koch in his laboratory, and the modifications of the same by Ehrlich were made use of—methyl-violet, fuchsin, and Bismarck-brown being used either singly or conjointly; the sections being decolorized always in nitric acid, as recommended by Koch.

In simple staining, the fluids used were hæmatoxylin (Delafield) with eosin, carmine, picro-carmine, safranin, methyl-violet, fuchsin.

Specimens were always studied in both glycerine and balsam.

Conclusions.—In the cases of tuberculosis of the thymus here presented, tubercle tissue appeared in the following forms:

1. As miliary tubercles, composed entirely of small round or polygonal cells with a reticulated basement-substance in the recent state.

2. In the later stages, these miliary tubercles or granula may, at their centres, undergo cheesy metamorphosis (coagulation-necrosis).

3. Miliary granula are also found which show, in their centres, the presence of giant cells.

4. Large cheesy areas, in the periphery of which we find still miliary tubercles or granula composed of giant cells, around which are arranged spheroidal or polygonal cells in a fine reticulated basement-substance.

5. In all cases the arteries of the adjacent areas of the thymus tissue were the seat of a typical endarteritis (in some cases obliterating) of a tubercular character.

6. A very careful and painstaking examination of the above forms of tuberculosis of the thymus, showed that the bacillus tuberculosis was present in all cases. In most of the above forms we had also the presence of the bacillus in the walls of the arteries and arterioles undergoing tubercular changes, and also in the lumen of the vessels with more or less obliterating changes.

7. In the thymus, tuberculosis may appear simply as so-called tubercle tissue, an infiltration of the tissue of the gland or organ with spheroidal or polygonal cells held together by a delicate basement-substance; this tissue has no characteristic arrangement; the arteries in such areas may be the seat of obliterating processes, and in all the cases examined by us there were present the characteristic bacillus tuberculosis.

Diphtheria of the Thymus.

The thymus glands from nine cases of diphtheria were examined. They were cases of diphtheria of the fauces, or larynx; and in all of them the diphtheria was extensive, and in some was accompanied by broncho-pneumonia. Autopsy, as can be seen in the histories, showed enlarged bronchial and cervical lymphatic glands. The methods of study in all of these cases was the same, on the whole, as that pursued in the cases of tuberculosis. In only two cases were any marked changes found. In the remaining cases the changes from the normal were not evident on microscopical examination. In the thymus from which Plate XIII. was made, the appearances sketched were scattered in small areas throughout the thymus. These areas were less consistent, and when hardened it was more difficult to obtain sections of them than of the rest of the organ.

Though the thymus was well hardened, the portions in which the picture (Plate XIII.) was duplicated seemed to be undergoing a

beginning disintegration. The other case in which similar appearances were found was a severe fatal diphtheria with sepsis at the umbilicus.

The appearances are as follows:

In the medullary portion, or sometimes the zone of the cortical portion of an acinus bordering on the medullary portion, there were found irregularly shaped areas, of a structure distinctly different from that found normally, and staining differently with hæmatoxylin or fuchsin from the surrounding tissue. With hæmatoxylin and eosin they stained of a dirty pink hue.

These areas were distinctly bounded by a narrow zone of small round cells, not differing in any way from the lymphoid cells commonly found in the normal thymus. The areas themselves consisted of irregular, large, coarsely granular cells, resembling large epithelial cells; between these were small round cells, granular detritus, and free large, irregularly shaped nuclei.

In these areas bloodvessels were distinct. Some cells contained more than one nucleus, others showed the nuclei irregularly shaped or constricted. Some of the cells contained large vacuoles. Making due allowance for the effects of hardening fluids, it was difficult not to surmise that some of these queer-shaped nuclei were the effect of a beginning process of division (karyokinesis). The bloodvessels showed no changes.

These areas were very plentiful in this thymus. The thymus, on the whole, reminded one very much of the pictures given by Oertel of changes in the lymphatic glands in cases of diphtheria (necrobiosis), though not so advanced as in the cases examined and pictured by him.

One of the cases examined was that of a newly born infant. I give a few particulars because of the comparative infrequency of diphtheria of the newly born.

Case IV. *Diphtheria; sepsis.*—Hilda Myers, born February 28, 1888. Mother showed signs of septic infection March 3d, followed by pelvic abscess.

March 5. Child. Umbilicus, redness size of a silver dollar. Infiltration extending nearly to ensiform appendix and pubes. Slightly bloody mucous discharge from the nose. Pulse 90.

6*th.* A.M. Infiltration decreasing, softening of the right side nearly to umbilicus. Throat red, no exudation. Pulse 100. P.M. White patches on the tonsils and pharynx. Pulse 90.

7th. Exudation in the throat increased. Pulse, A. M., 100; P. M., 96. Respiration, A. M., 40; P. M., 40.

8th. Does not swell. Cyanosis marked at times. Respiration irregular. Infiltration extended over abdomen. Pulse, A. M., 100; P. M., 112. Respiration, A. M., 40; P. M., 40.

9th. Died 6.30 A. M.

In this case the temperature ranged from 99½° March 5th, to 104° March 6th, it then dropped to 99¾° March 7th A. M. It rose again to 102¾° March 8th A. M., then dropped suddenly to 97°, the temperature at time of death.

CASE V. *Diphtheria with nephritis and convulsions.*—Frederick S., aged three years, twenty-two days. Returned from boarding April 16th. Soon appeared ill; some amygdalitis.

April 22. Hoarse, slight cough.

26th. Tonsils very large. Membrane over tonsils and pharynx. Swelling of the cervical glands.

28th. Has steadily grown worse in the throat and general condition. 4 A. M. convulsions. 4.30 A. M., died.

Autopsy. 28th, 1.30 P. M.—Body well nourished. Pericardial fluid red, but no blood corpuscles to be found.

Tonsils the seat of diphtheria; sloughing, membrane in pharynx, œsophagus and larynx and trachea. Catarrhal bronchitis; a good deal of pus. No pneumonia.

Liver fatty.

Bronchial glands enlarged.

Kidneys, markings indistinct, cortex swollen, pale. Urine (P. M.), granular and hyaline casts.

Body, 25 pounds; heart, ʒij ʒiiiss; liver, ℔.j ʒviij; spleen, ʒij ʒviiss; thymus, ʒiij gr. iij.

SYPHILIS.

Parrot, who had an extensive experience in syphilis, and for that reason and because he was rather given to overestimating the ravages of that disease than otherwise (according to him, rhachitis is a disorder derived from hereditary syphilis), cannot be expected to have overlooked it where present, denies ever having met with syphilis in the thymus. The reddish or yellowish nodules he often found in it, consisted of connective tissue undergoing fatty degeneration in the normal process of retrogressive metamorphosis. L. Fürth, however, found seven cases of thymus, which he claimed as syphilitic, in two hundred autopsies made on infants who died with congenital syphilis. In such cases the occurrence of tangible changes, such as gummata, is not required. The characteristic changes of the bloodvessels, which

may terminate in vascular obstruction, or in hemorrhages, are sufficient to establish the diagnosis.

There are two cases of hemorrhage of the thymus gland in the *Archiv für Kinderheilkunde*, vol. 4, p. 21, 1883. In one case the mother was known to be syphilitic. The child developed normally for forty-five days, with the exception of a cephalhæmatoma and a smooth nævus on the abdomen. On the forty-fifth day it was suddenly taken ill. There was no albuminuria, but the epithelial "pearls" on the hard palate were found to be stained with blood. Thus the infant died. The left lobe of the thymus was enlarged. Near its hilus was a triangular area of whitish tissue, adjacent to which the tissue was tinged with blood and of a grayish-red color. On its edges the tissue was very smooth and purple. There was blood in the pleural cavities, and recent coagulations in the temporal and occipital fossæ of the cranium.

In the second case the mother was unknown; the baby developed normally until the tenth day. At that early age there were some symptoms of rhachitis. Besides, there were irregular, contracted cicatrices on the skin. The left lobe of the thymus was quite large. In it there was a hemorrhage of the size of a walnut. In the surrounding cellular tissue and on the hard palate there were punctated hemorrhages. There was blood in the stomach and on the surface of the kidneys.

Similar cases are reported by F. Weber in the thymus of the fœtus and the newly born, and there were found general hyperæmia, hemorrhages of the size of a pin and upward; besides, there were hemorrhages in other places, isolated, or a great many in the same locality.

Abscesses of the thymus depending on primary inflammation appear to be very rare. Normally, there are sometimes found accumulations of a milky fluid which is, or may have been, taken for pus. In the large majority of cases in which abscess has been reported, there is also the history of a constitutional disorder. Paul Dubois published a report of four syphilitic fœtuses with disseminated deposits of pus in the thymus gland. Haugsted has the report of two young men, syphilitic and tuberculous, in whose thymuses, which were persistent, pus is said to have been found. Mewis (*Zeitsch. f. Geburtsh. u. Gyn.*, 1879, iv. p. 57), has the following cases: one was that of a fœtus stillborn in the eighth month of utero-gestation. The mother was

reported to have been in good health, but in the centre of the placenta there were several firm yellowish nodules of the size of a hazelnut or less. In the fœtus there were gummata of the lungs, liver and spleen were enlarged, the pancreas was indurated, the mesenteric glands large, and there was found a syphilitic ostitis. There were also a discoloration and a swelling, sometimes amounting to stenosis, of the intima of the veins and arteries, such as are found in syphilis. The thymus was of its normal size, its tissue denser than normal, containing an abscess. No pustular syphilides.

The second was a male fœtus born dead at the end of the eighth month. The history of the mother pointed to syphilis, and in the fœtus there were syphilitic pemphigus, gummata in the lungs, spleen large, pancreas large and indurated, suprarenal capsules large and hemorrhagic. There was syphilitic ostitis. The thymus was large, contained a large number of small abscesses of the size of a pea, with pus of yellowish-green color and thick consistency. Similar observations had been made by Zeissl in cases complicated with syphilitic pustules.

The following cases of ours were examined:

Case VI. *Congenital syphilis; broncho-pneumonia.*—Josephine C., aged three months and three weeks. Admitted November 2, 1887, when three weeks old. Was then in poor condition; conjunctivitis (syphilis?). Returned from boarding January 9, 1888. Emaciated; liver enlarged; spleen slightly enlarged; snuffles; enlarged cervical glands. Continued to fail; died February 2, 1888, 10 A.M.

Autopsy. Feb. 2, 1 P.M.—Body poorly nourished; broncho-pneumonia left lower lobe; cervical glands enlarged; liver enlarged; spleen slightly enlarged; bronchial glands enlarged. Body, $6\frac{3}{4}$ pounds; heart, ʒv; liver, ℥vj ʒij; spleen, ʒvss; thymus, ʒss.

Case VII. *Congenital syphilis; enteritis.*—Arthur W., admitted January 30th, aged two months. Sore mouth; ulcers about genitals; snuffles. Syphilis? Bottle-fed; failed.

Feb. 13. Stupid, slight cough, neck stiff, enlarged inguinal and cervical glands.

14*th.* Pulse 160; temp. 102°; diarrhœa; pupils contracted.

15*th.* Some symptoms of meningitis. Abdomen retracted, flabby, doughy; neck stiff and held back, slight spasmodic action of arms, but respiration regular, 23. Pulse 132; temp. 99½°; passed a little blood with stool yesterday.

16*th.* Died at 3 A.M.

Autopsy. 2 P.M.—Body very poorly nourished; lungs negative. Bronchial glands not enlarged. Mesenteric glands slightly enlarged, not tubercular.

Inguinal and cervical glands as above. Brain normal. Intestines: contents thin and watery with mucus. Body, 6½ pounds; heart, ʒv; spleen, ʒiijss; liver, ʒiv ʒj; thymus, grs. lxiv.

In this thymus the following growth was found. Macroscopically it appeared as a spheroidal mass one and a half mm. in diameter, grayish-yellow in color. It was limited by a distinct zone, which under the microscope was composed of fibrillar connective tissue in which were spindle-shaped and round cells. The central portion of the mass consisted of a hyaline area occupying from one-third to one-half the diameter of the growth. This hyaline mass stained diffusely with eosin and hæmatoxylin, and contained a few oval nuclei situated at the sides of empty oblong spaces; these spaces, which were non-communicating, contained in places detritus. The nuclei and spaces indicated capillaries which were now almost obliterated by this process of hyaline degeneration. Around this central hyaline mass and occupying the space between it and the connective-tissue limiting zone, was a mass of spheroidal cells among which were very thin-walled vessels. In places where the small round cells were not so compact a transparent reticulum containing spindle-shaped cells could be made out. The above round cells were smaller and stained more deeply with hæmatoxylin than those in the acini of the thymus.

Diagnosis.—In the absence of any positive presence of a similar growth in other parts of the body, the nature of the above can only be surmised. Tuberculosis being excluded, the assumption that the above is a gumma in process of formation appears plausible.

The sections show in places an absence of that distinct marking into follicles seen in the thymus. In other places these markings are distinct, though fading off into the surrounding connective tissue. This changed appearance is caused by the presence of an excessive amount of connective tissue as compared with the parenchyma.

The parenchyma is much reduced by the encroachments of the connective tissue. This connective tissue when stained appears more transparent than the fibrillated connective tissue in other parts of the organs, where the markings of the acini are still distinct. The encroachments of connective tissue are first seen in the cortical part of the follicle. This connective tissue, apparently of recent formation, is composed of a transparent finely fibrillated basement-substance containing spindle-shaped and round cells.

Fat tissue is present to a marked degree in the midst of the parenchyma of the acini.

The bloodvessels show similar changes to those seen in another case.

Case VIII. *Congenital anasarca; syphilis (?).*—James D., seven months miscarriage; lived fifteen minutes. Mother had severe albuminuria and miscarriage as above, 3 A.M., February 29th; child lived fifteen minutes, and breathed eight or ten times. Placenta pale (œdema?). Abdomen greatly distended; anasarca neonati.

Autopsy. Feb. 29, 2 P.M.—Abdomen contained about eleven ounces ascitic

fluid, clear amber; body œdematous, small hemorrhages everywhere in the skin and in the tissues; blue veins over the abdomen. Development good. Liver large. Right lobe contained small lime concretions found by the microscope to lie in the veins. Kidneys: small lobulated hemorrhages. Spleen large. Lungs: partial aëration. Body, ℔. iv ℥j ℥j; liver, ℥ij ℥vss; heart, ℥iijss; spleen, ℥vss; thymus, grs. xxiv.

In this thymus, as in Case VII., the amount of connective tissue far exceeds the area occupied by the tissue in the follicles or acini. Not only is the connective tissue (fibrillar with spindle-shaped and round cells) marked in the spaces between the acini, but it is seen to encroach markedly on the tissue of the follicle, and in places replace it to a large extent. The blood-vessels of the connective-tissue septa or the acini, present no changes other than seen in Case VII.

The parenchyma of the follicle presents nothing pathological but the presence of connective tissue forming, or in an advanced state, giving the appearance as if the follicles were traversed by bands of a tissue composed of a finely fibrillated basement-substance, containing a large number of spindle-shaped and spheroidal cells.

Case IX. *Congenital syphilis; opisthotonos.*—Irene C., age six months.

March 6. Always in poor condition, but has been failing since yesterday; constipated when admitted six weeks ago; not constipated now; yesterday, slight cough, rapid pulse. Physical examination: Slight dulness on the left side behind lower lobe; bronchitis on both sides, not marked. Yesterday and to-day slight vomiting, restless, erythema over the chest and face. P.M., temperature 103°. No enlarged glands.

7*th.* Rested well, nursed well.

9*th.* Opisthotonos; marked at times. Temperature last night, 104.6°. This A.M., 103.2°. Cracks and fissures about the mouth (eczema?). Very restless; bowels irregular, stools white and constipated; vomiting. Nurses. P. M., marked opisthotonos. 10.15 P. M., opisthotonos extreme and continuous, thighs and legs flexed strongly; no loss of sensation apparent. Neck very stiff.

16*th.* Enlargement of glands in left submaxillary region. Temperature slightly elevated.

18*th.* Pale red eruption over face and the whole body, especially the legs, soon fading from body and extremities. Opisthotonos continues in spite of opium.

21*st.* Opisthotonos has gradually increased, head very much extended, eruption faded somewhat, but returned again, and again faded almost entirely. Glands in the left submaxillary region have increased greatly in size. Temperature remains slightly elevated, no abscess found.

23*d.* Died 11.30 P.M.

Autopsy. 24*th*, 1 P.M.—Body emaciated; no rigor mortis. Lungs: Bronchopneumonia left side, lower lobe. Liver congested. Bronchial glands enlarged, not cheesy; mesenteric glands enlarged; inguinal glands enlarged; cervical

glands enlarged, especially on the left side. Kidneys congested, markings distinct, slightly enlarged, firm.

Urine P.M., no casts. Tabes cranii, beaded ribs, fontanelle very open, internal ear on each side normal. Bone behind the external ear on the left side over a small area (one-quarter inch) bare. No abscess cavity.

Brain normal, spinal cord normal; long bones, articulations congested, but condition not absolutely diagnostic of syphilis, though suspicious. Body, ℔. vj ℥xv; heart, ʒvss; liver, ℥v ʒj; spleen, ʒvj; thymus, grs. xlj.

The amount of connective tissue in this thymus, as compared to that generally seen in the organ normally, is quite marked, and the follicles give the gross appearance under a low power, as if blending or fusing into one another. They have a closely packed, flattened appearance. The acini are traversed by transparent bands of connective tissue; this connective tissue is of a fibrillated character, and contains spindle-shaped and round cells. The basement-substance has a transparent, finely fibrillated appearance. There are areas in which the above connective tissue has almost entirely replaced the parenchyma of the follicle.

The bloodvessels show the changes seen in organs which are the seat of interstitial connective-tissue increase. The walls are all uniformly thickened (see remarks). The adventitia is, in many vessels of small size, surrounded by a zone of connective tissue containing spindle-shaped and round cells, arranged concentrically (this is seen in thymuses taken from subjects dying from other causes than syphilis). The above changes in places are more marked in the cortical zone of an acinus.

CASE X. *Congenital syphilis* [?]; *diarrhœa*.—Medora C., aged seven months and five days, returned from wet-nurse February 3, 1888; emaciated; afterward bottle-fed. Cervical and inguinal glands enlarged. Liver and spleen appear normal in size. Continued to fail slowly; diarrhœa occasionally.

April 17. 6 A.M., died.

Autopsy. 17*th*, 2 P.M.—Body emaciated; lungs normal; spleen normal; liver slightly large, congested; heart normal. Kidneys appeared normal, except that they were much congested. Peyer's patches slightly swollen and congested. Cervical and inguinal glands enlarged; mesenteric glands enlarged; bronchial glands not enlarged. Body, 6¾ pounds; heart, ʒ vss; spleen, ʒiv; liver, ℥v ʒivss; thymus, grs. xxivss.

REMARKS.—The appearances, both as to weight and size of the thymus being so variable at different ages, it was attempted to discover whether the thymuses taken from infants at the same, or about the same ages as those taken from syphilitic subjects presented the same, or nearly the same, appearances under the microscope. In many cases so examined the ages not only equalled those of the syphilitic children, but were some of them either younger or older (one, five and a half years). In no case, whether the thymus was taken from a newborn

infant, or one dying with tuberculosis or diphtheria, could exactly the same appearances be duplicated.

Reference is now more particularly had to the immense quantity of connective tissue in the thymuses taken from syphilitic infants whether the thymus be small or large. In one case in which the history simply suspects syphilis, the changes already described were duplicated, but to a very marked degree. In one of the cases the thymus was taken from a premature child (a miscarriage of seven months). The thymus was very small, and weighed twenty-four grains, but showed the most marked amount of connective tissue, as seen by the description.

The bloodvessels in all the cases examined did not show changes limited to any particular coat of the vessel, but a general thickening of all the coats. In some places, both in the interstitial septa and follicles, the vessel was found simply replaced by a ball of connective tissue. But between these two forms no intermediate forms were seen. That is, no vessel was found in which the intima was the seat of thickening, as seen in the cerebral or other arteries which are the seat of endarteritis obliterans. The changes seen resemble those found in chronic interstitial inflammations of the liver or kidneys.

FROZEN SECTIONS OF THE NEWBORN INFANT.

PLATE I.

In this section the cut passes just beneath the cricoid cartilage in front, and behind the *fourth cervical* vertebra is seen.

The plate being photographed from the inferior cut—that is, the section which lay beneath the knife, the body being upright—we must imagine ourselves looking down upon the cut body. If we turn the vertebra toward us, the right of the subject corresponds to the right of the plate. In front is seen the trachea cut just below the cricoid cartilage surrounded by the lobes of the thyroid gland on each side. The thyroid stretches here in front and behind, encroaching also on the œsophagus, which is directly behind the trachea. The œsophagus juts directly on the vertebra, which is seen to be cut at the intervertebral cartilage, exposing its body. Outside of all these parts is seen the skin, which just covers the shoulders of the infant. The relation of the larger vessels is best seen in the actual specimen.

PLATE I.

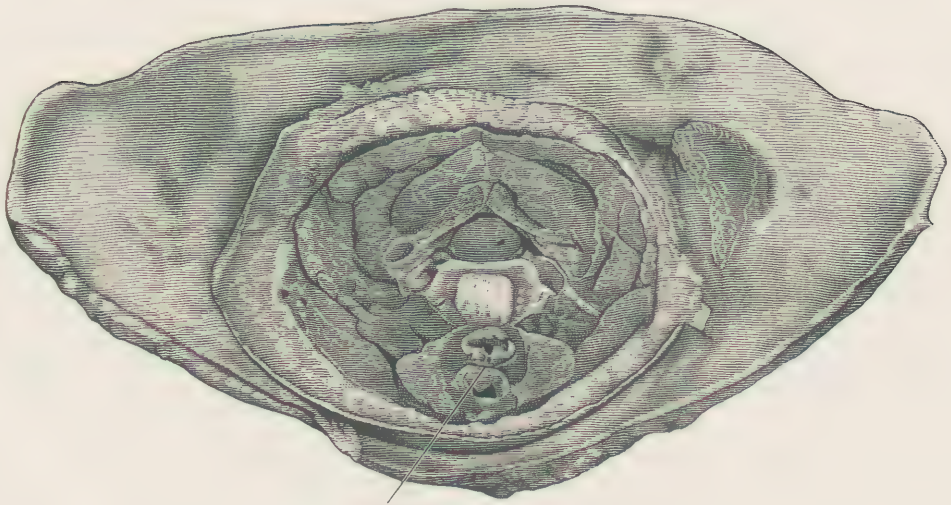


PLATE II.

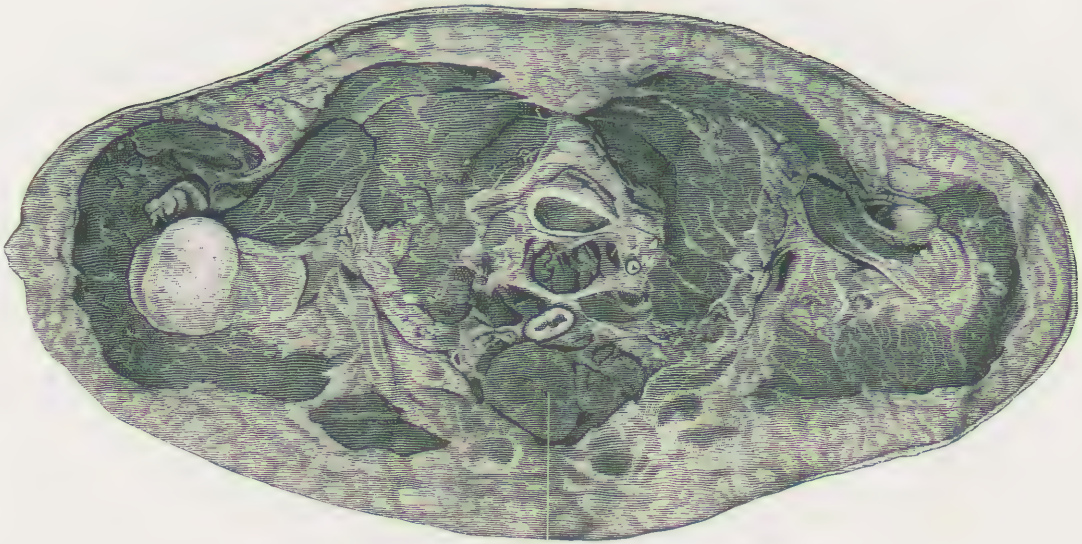
Imagining the body upright, this section lays *above* the knife. It was, therefore, facing downward; the parts being turned upward and photographed, we must consider ourselves looking at the section from below upward. Holding the section in the same position as in Plate I., the right of the subject is to our left, and the left of the plate.

The tops of the heads of the humeri are seen here just grazed by the knife. In front are seen the insertions of the sterno-cleido-mastoid just above the sternal notch.

Behind these two landmarks is seen the *thymus*, with its two lobes, and the large vessels of the neck on each side.

Behind the notch, between the two lobes of the thymus, is seen the trachea, its anterior curved portion of cartilage, the posterior soft collapsed portion. Posterior and to the left is seen the œsophagus. Posterior to the œsophagus is the cut body of the sixth cervical vertebra.

PLATE II.



Thymus.

PLATE III.

This section is made and situated as to the knife exactly as that of Plate II.

In front is seen the junction of the first rib with the sternum.

Behind the cut passes through the body of the first dorsal vertebra. Just behind the first piece of the sternum is seen the thymus (the darker portion) of an irregularly oval form.

To the right and behind the thymus is seen the collapsed innominate artery.

Behind the centre of the thymus is seen the trachea, behind and to the left of the trachea the œsophagus.

The apices of the lungs are seen on each side. Outside of the above district the heads of the humeri are seen, and behind obliquely stretching backward the scapulæ.

It is to be noted how the thymus occupies in this infant the greater portion of the superior opening of the thorax in the recent state.

PLATE III.

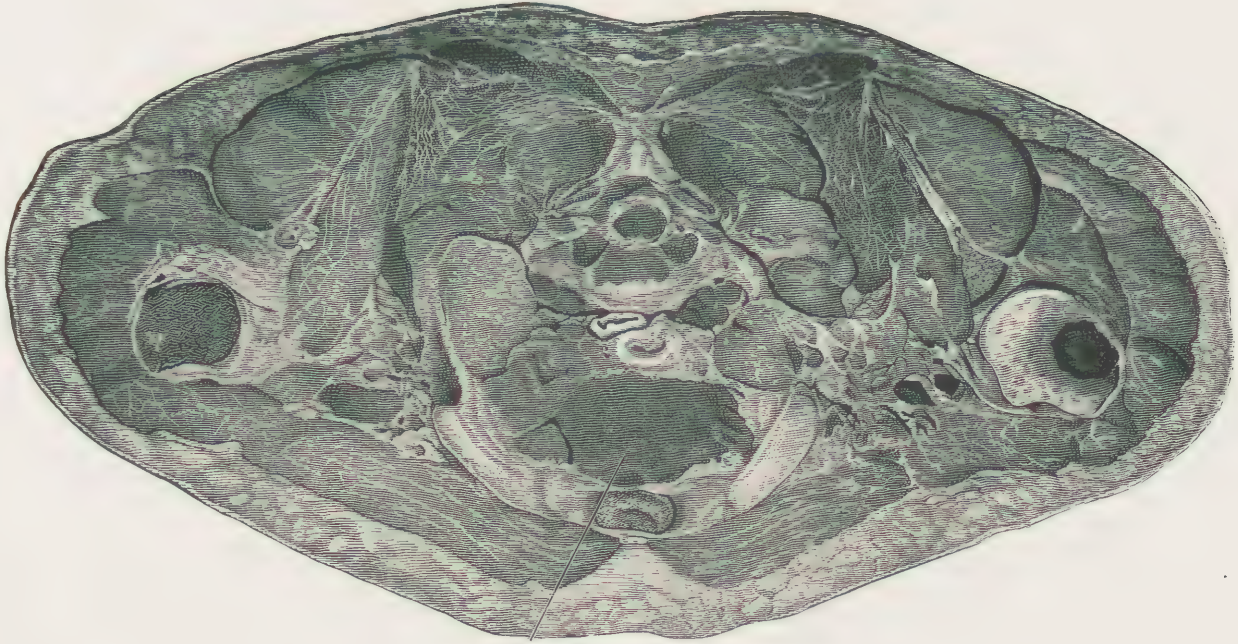


PLATE IV.

Behind is seen the body of the third dorsal vertebra. In front is seen the sternum at the level of the second rib.

The inferior surface of the section is shown in the plate, so that the parts are looked at from below.

The plate being held with the vertebra toward us, the right of the plate corresponds to the left of the child.

In front the large oval mass of the thymus is seen situated in the anterior mediastinum,

Posterior to this is the superior part of the aorta cut just below the points of origin of the innominate and carotid.

The œsophagus is situated to the right and behind the aorta.

The large extent of space occupied by the thymus is caused by its oblique position to the transverse direction of the cut.

PLATE IV.

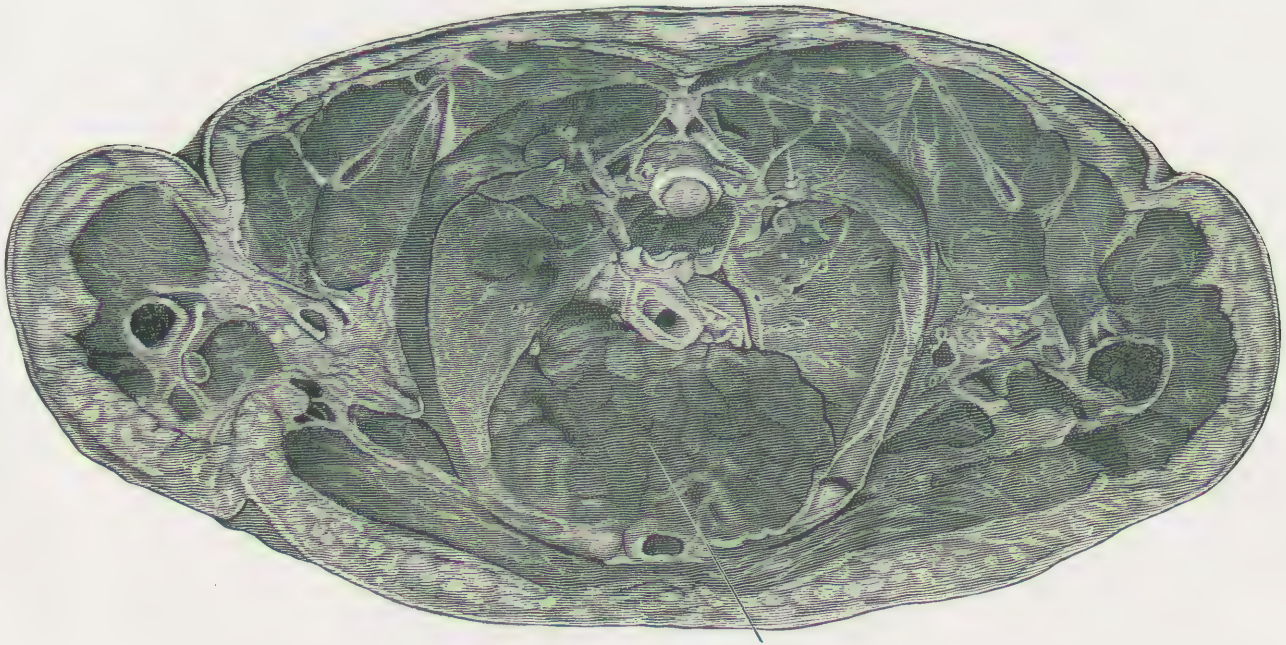


PLATE V.

Looking at the section from below upward. In front is seen the middle piece of the sternum. Behind, the body of the fourth dorsal vertebra. The ribs stretching between are indicated by the insertion of the intercostal muscles.

The section is cut on one side just beneath the axillary fold, on the other side it grazes this fold. The heart here forms a very good starting-point. The mass of the right ventricle is seen. The right and left auricles on each side above. The roots of the two lungs on each side behind the auricles. The unaërated lungs on each side. The œsophagus behind and to the right lying on the body of the vertebra. The inferior surface of the body of the vertebra is seen. The *thymus* is here shown as a pear-shaped body, the point of the pear stretching back. It is situated here between the heart and the anterior border of the right lung. In the specimen itself it lies on the anterior surface of the anterior layer of the pericardium. The peculiar shape here shown is caused by the oblique position of the heart and the thicker anterior border of the thymus.

PLATE V.

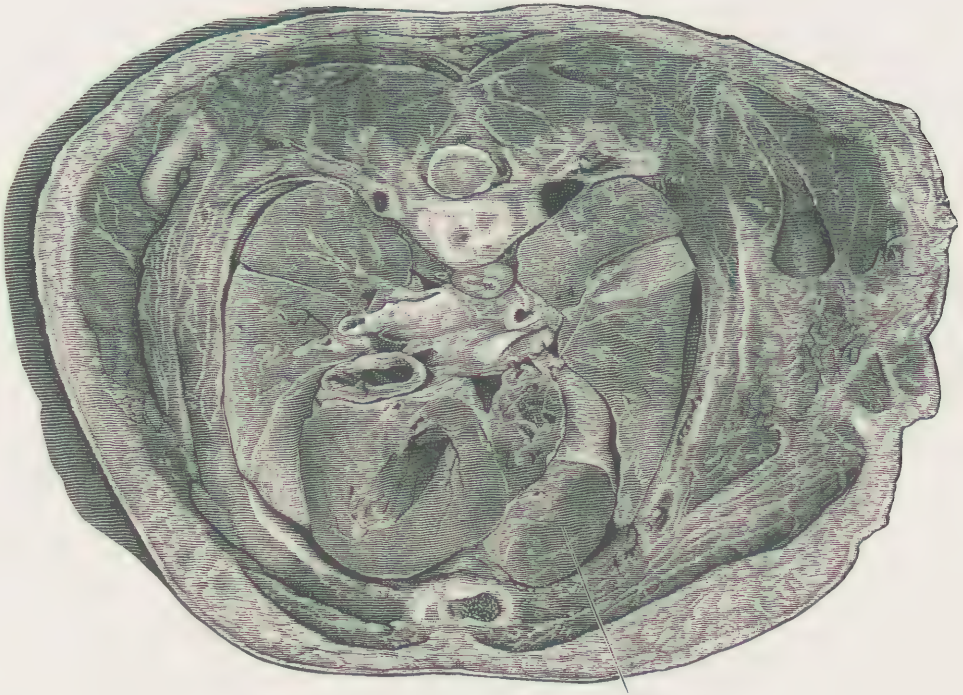


PLATE VI.

This section is the companion cut to the one of Plate V., fitting just below it. It was below the knife, while that of Plate V. was above the knife; we are here looking *down* on the section. Holding the plate, as in Plate I., the right of the plate corresponds to the right of the infant. Behind we see the body of the fifth dorsal vertebra. In front, the sternum.

The heart is seen surrounded by the pericardium, which is indicated by a rough line surrounding the heart. The right and left auricles are seen, as also the mass of the left ventricle, the walls of which are exposed to the left of the plate (holding the plate with the vertebra toward you). To the right are seen the walls of the right ventricle and part of the cavity of the same.

The *thymus* is seen to the right of the pericardium as a small, ragged oval piece of tissue, partly overlapped by the anterior border of the right lung. The unaërated lung with its fissures and roots is shown. The specimen having been prepared in strong alcohol, the shrinkage shows an exaggerated pleural space.

PLATE VI.

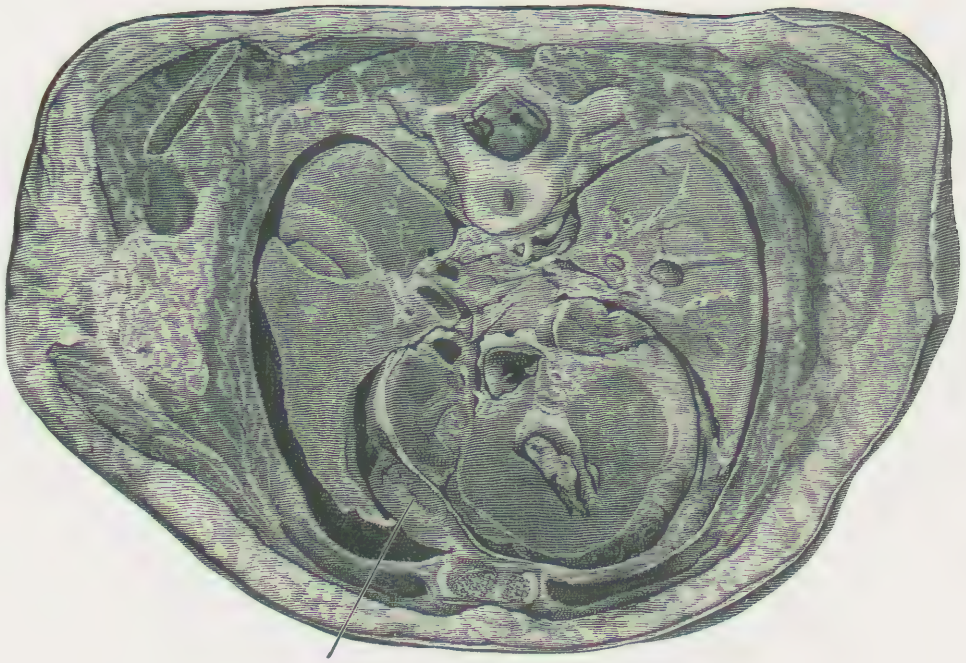


PLATE VII.

This section was taken from a child whose age, as near as could be calculated (post-mortem), was about two months. The cause of death was bronchopneumonia.

To understand this plate, we must imagine ourselves looking at the section from below upward with the vertebra of the subject toward us. The right of the plate corresponds to the left of the child.

In front is the top of the second piece of the sternum.

Behind is the inferior portion of the body of the *third* dorsal vertebra. The lungs are cut just above their roots.

The arch of the aorta occupies the centre of the plate.

Behind the aorta are seen the œsophagus and the right bronchus. *In front* of the aorta, occupying the anterior mediastinum and surrounded on the outside by a reflection of the pleura, is seen a triangular structure, the *thymus*.

This plate and accompanying mounted section show well the position of the thymus in the mediastinal space.

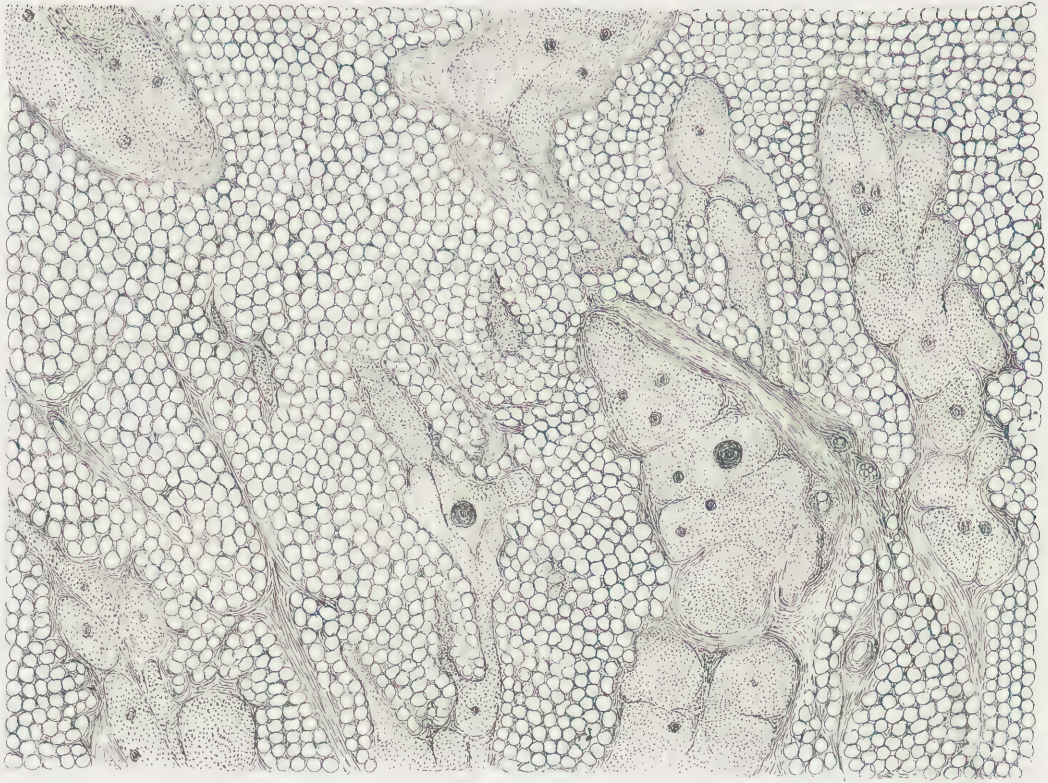
The mounted hand specimen belonging to the above plate shows a view of the superior surface of this section. Here the position of the thymus to the arch of the aorta and the points of origin of the great vessels of the neck, and the very close relation to the trachea, are well shown.

PLATE VII.

PLATE VIII.

Adult persistent thymus. (See p. 305.)

PLATE VIII.



TUBERCULOSIS OF THE THYMUS.

All the plates are drawn accurately from the actual specimens by means of the Abbé camera lucida.

PLATE IX

is a section of a portion of the thymus of Case I. The drawing is simply topographical, and is intended to show the manner of eruption of the miliary tubercles in the acini of the thymus. The miliary tubercles are represented in the upper part of the picture as irregularly round bodies with lighter centres (cheesy) in the midst of the thymus tissue. The normal acini are represented with a darker external zone (cortical), and a lighter central zone (medullary portion).

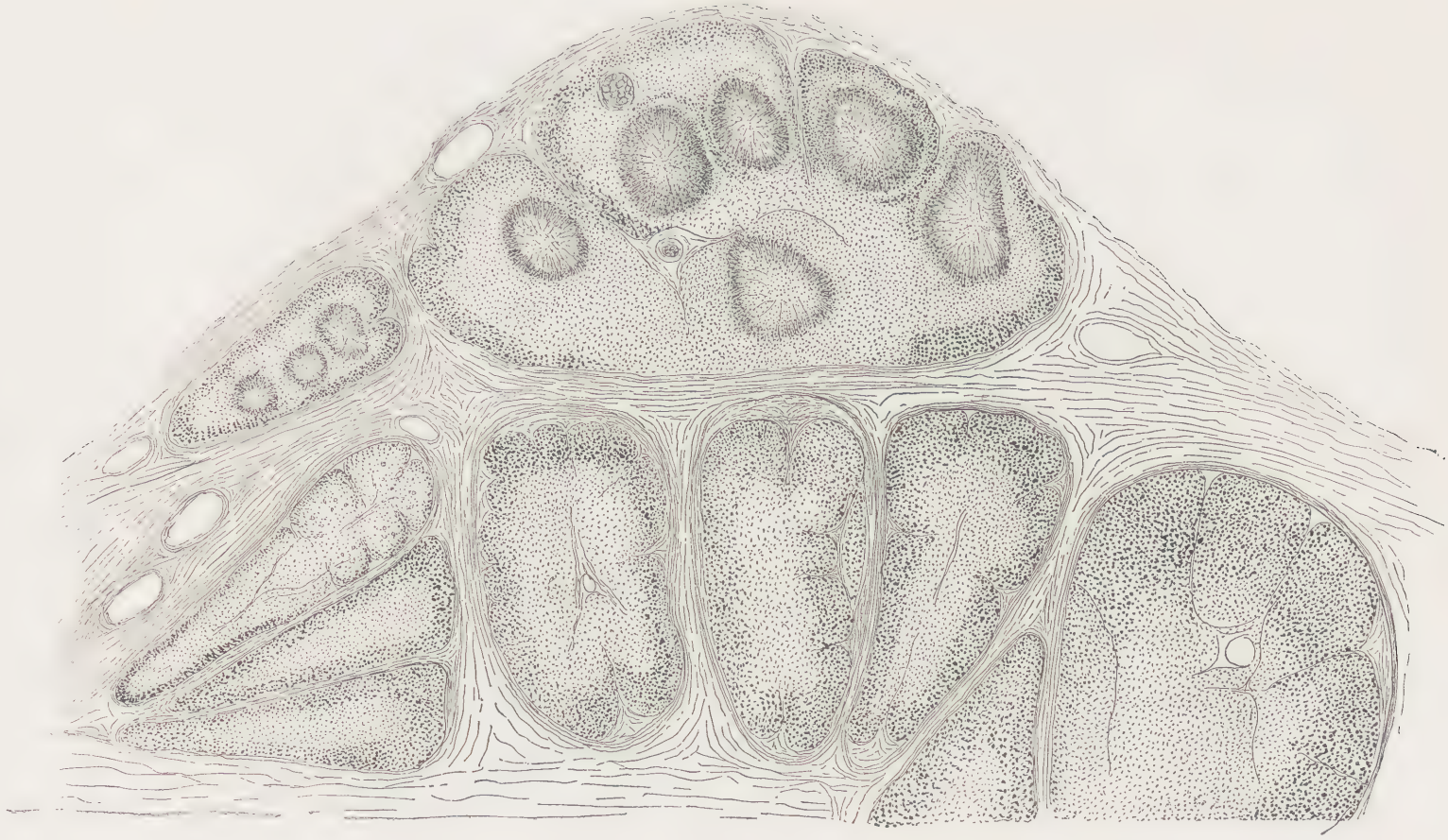


PLATE X. (× 185 diameters)

is also taken from Case I. It is intended to show more closely the structure of the miliary tubercle, its periphery and cheesy centre. The tissue between is represented by closely packed round cells, rich in bloodvessels, which are naturally injected with blood. The reticulated structure of the periphery of the basement-substance of these miliary substances is shown here as small spaces, from which the round and polygonal cells have been shaken by manipulation.

PLATE X.

PLATE XI. (× 85 diameters)

is the periphery and central portion of coagulation-necrosis of a cheesy nodule of the thymus; here the tubercle granula, unlike the *previous specimen plate*, show giant cells. Some of the granula have cheesy centres; the spaces between the granula are filled with small round cells.

PLATE XI.

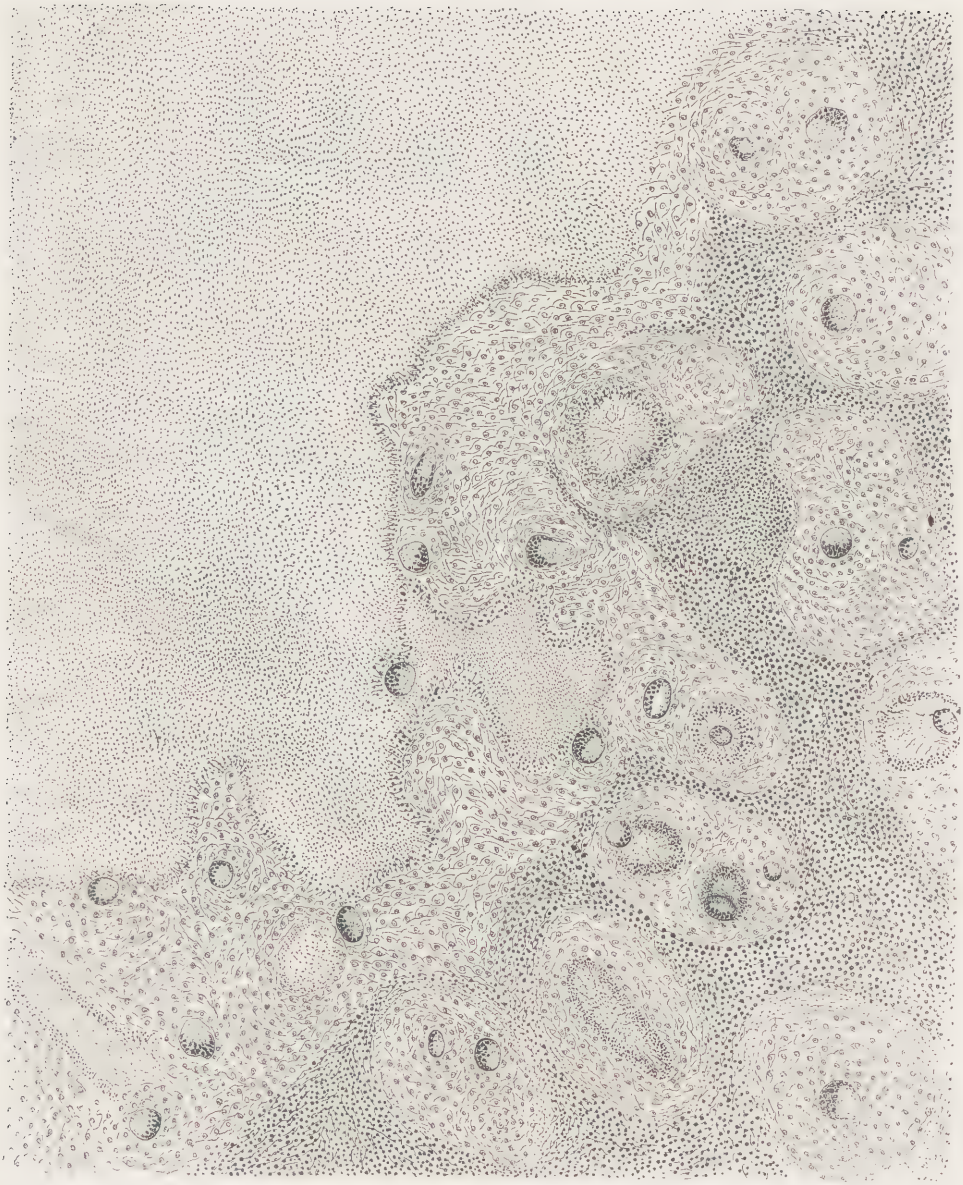
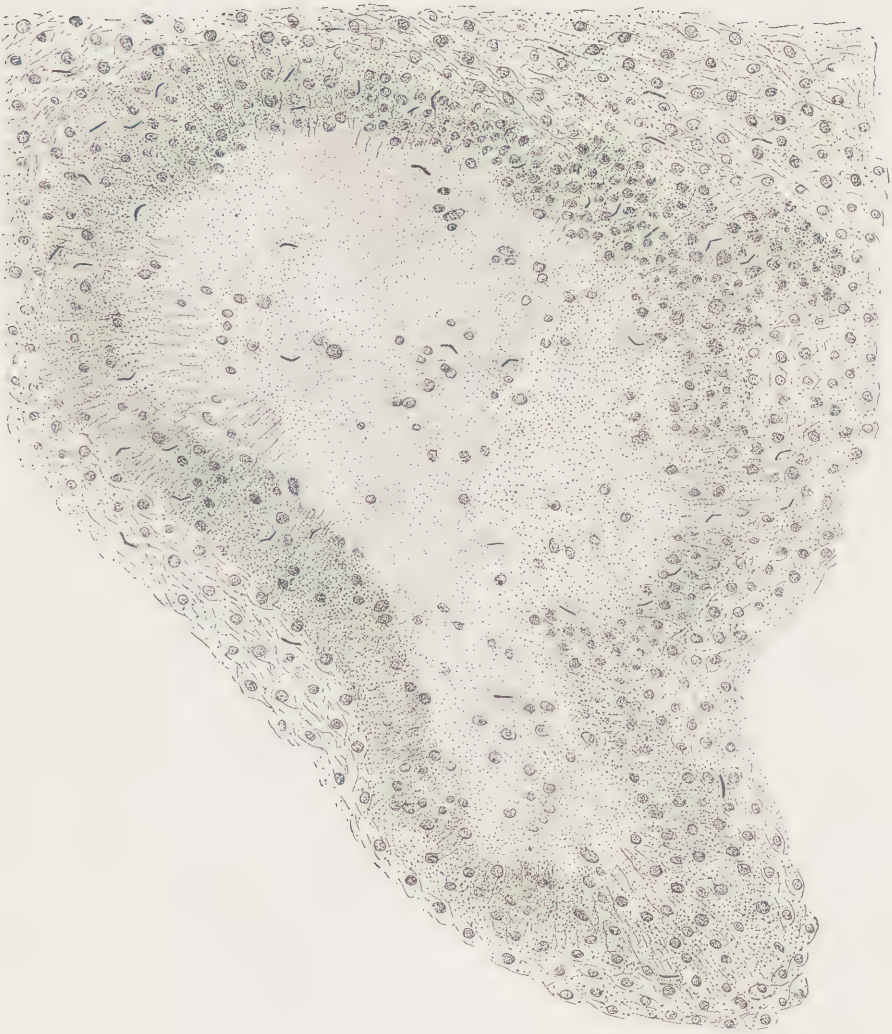


PLATE XII. ($\times$ 550 diameters. *Tubercle bacilli*)

shows under a high power the appearance of a miliary tubercle of Case I.

The specimen prepared by Koch-Ehrlich method to show tubercle bacilli. The miliary tubercle (decolorized) was first drawn with the camera lucida, the tubercle bacilli were counted with an immersion $\frac{1}{12}$, and then as near as possible drawn into the sketch. The tubercle bacilli are, therefore, a little exaggerated as to their actual size and thickness for the sake of illustration. They are seen in *moderate numbers only*, and are found in the cheesy centre, in the periphery of the miliary tubercle and in the tissue between the miliary tubercles.

PLATE XII.

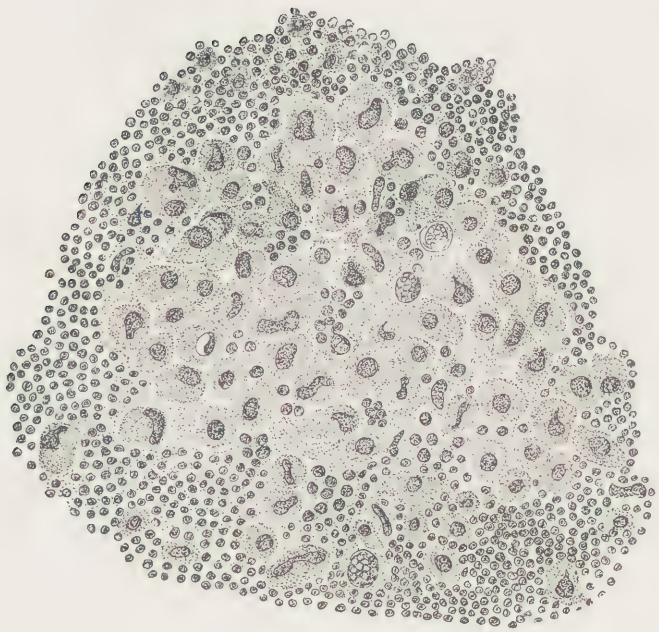


THYMUS IN DIPHTHERIA.

PLATE XIII.

Thymus from a severe case of diphtheria.

PLATE XIII.



SYPHILIS OF THE THYMUS.

PLATE XIV.

Gumma (?) in the thymus.

a. Cheesy centre; *b*. Small round cells; *c*. Thymus tissue; *d*. Bloodvessel; *e*. Connective tissue zone; *f*. round-cell infiltration.

PLATE XIV.